Finally, in the neighborhood of Frankfort, to a distance of perhaps 100 kilometers, stations will be located, whence warnings will be sent to the weather service station at this place of the approach of thunderstorms and squalls and, after they have past, reports by telegraph of the time and direction of path. By means of such despatches the time when such storms will reach Frankfort can be calculated with tolerable accuracy. Signal stations will be located at conspicuous points, from which storm warnings can be sent to balloons and other air craft by means of optical signals; possibly also by wireless telegraphy.

Doctor Linke does not exaggerate the importance of this project when he says:

> The wider object of this organization is, of course, the acquisition of knowledge and experience *for the coming era of aerial navigation;* the consummation of which, on account of the uncertainty of atmospheric conditions, is impossible without the previous improvement and extension of the weather service. That such an undertaking will at the same time increase our knowledge of atmospheric processes and thereby improve the accuracy of the forecasts, is evident. *Aeronautics and meteorology support each other,* neither can dispense with the other.

It is perhaps not too much to say that the execution of this project will mark the beginning of a new era in practical meteorology—an era in which, ultimately, all the weather services of the world will be called upon to extend the benefits of their forecasts and warnings to the navigators of the air. The development of aeronautics means *the enhancement of the importance of meteorology among the sciences and in the domain of practical affairs.* The rapid progress that this art has made within the last few years must, therefore, be a source of gratification and encouragement to all meteorologists.

THE ARGENTINE METEOROLOGICAL STATION IN THE SOUTH ORKNEYS.

The corvette *Uruguay,* of the Argentine Navy, left Buenos Ayres on January 14 for the meteorological and magnetical station at the South Orkneys. The relief party sent out by the Argentine Meteorological Office consists of four members, under the command of Mr. A. Lindsay, of Edinburgh, who received his early meteorological training at the Ben Nevis Observatory, and who for the past year has been in charge of the new meteorological observatory established at Port Madryn, in the territory of Chubut [Argentina]. The observations at the South Orkneys this year are likely to prove of unusual interest and importance owing to the comparative proximity of the Charcot expedition, which is to winter in the vicinity of Alexander Land. On the return voyage of the *Uruguay* a stop is to be made at Moltke Haven, South Georgia, in order to make magnetic observations in the same spot as that previously occupied by the German International Expedition of 1882–83. This work is intrusted to Mr. W. R. Bruce, chief last year at the South Orkney station, who, along with the rest of the party, returns with the *Uruguay.* The data from South Georgia will be of great value in connection with the elaborate magnetic survey of the Argentine Republic and adjacent regions which has been in progress for some years.—*Scottish Geographical Magazine, March, 1909, p. 151.*

AN INVERTED RAINBOW.

On April 9, 1908, an inverted rainbow was seen from the Italian geodynamic observatory of Rocca de Papa, by Professor Agamennone, the director of the observatory, and a party of visitors. The morning was showery; and when the visitors reached the observatory, 2,500 feet above sea level, and looked dawn on the vast Campagna, they were astonished to see projected on the vineyards and trees beneath a perfect rainbow, with its convex side down and its middle point bearing northeast. Inverted rainbows are very rare even in mountainous regions. None of the visitors, who were French and Italian meteorologists, had ever seen one, nor had Professor Agamennone, altho he had been director of the observatory for eight years. The phenomenon, however, is not unknown. It was observed from the Eiffel Tower, in Paris, in April, 1891. In this case there was a double rainbow, extending above and below the horizon to form two nearly complete concentric circles.—*Scientific American, March 20, 1909, p. 219.*

PRIZE OFFERED BY THE SCOTTISH METEOROLOGICAL SOCIETY.

The Scottish Meteorological Society offers, thru its council, a prize of £20 for the best essay on a meteorological subject. As an indication of the kind of essay the council are prepared to consider, the following subject may be mentioned:—

"A discussion of the extent to which the heat set free when water vapor is converted into the liquid state influences the temperature of the atmosphere, with special reference to the climatology of different parts of Scotland."

The council, however, wish it to be clearly understood that an essay on any subject will be equally eligible.

The following are the conditions on which the prize is offered:—

1. The competition shall be open to regular matriculated students of the four Scottish universities, including University College, Dundee, who have attended classes of mathematics and natural philosophy, or to graduates of the Scottish universities who at 1st January, 1910, shall be of not more than five years' standing.

2. The essays must be lodged with the secretary to the Scottish Meteorological Society, 122 George street, Edinburgh, on or before 31st March, 1910, with a statement of the candidate's qualifications to compete.

3. All essays must be legibly written, or typewritten, on one side of the paper only.

4. The council of the Society shall appoint a referee or referees to report on the essays, and the decision of the council as intimated by the secretary shall be final.

5. The council reserve the right to publish the successful essay in the Society's Journal. The other essays will be returned to the competitors.

R. T. OMOND,
E. M. WEDDERBURN,
Joint Honorary Secretaries.

DR. SERENO BISHOP.

We regret to learn of the recent serious illness and death, January, 1909, of Dr. Sereno E. Bishop at Honolulu, H. I. For more than a year Doctor Bishop had been partially paralyzed, altho his general bodily health has been good. Almost the last of his intelligent activities were his observations of the skies at the end of 1908, when he noted the haze, Bishop's ring, and some sky-glows too brilliant for the average atmosphere.—*C. A.*

SUMMARY OF ICE CONDITIONS OF THE GREAT LAKES.

By NORMAN B. CONGER, Marine Agent. Dated Detroit, Mich., March 2, 1909.

The reports from the regular and display stations of the U. S. Weather Bureau indicate that there is much less ice in all the lakes than was reported last season. In Lake Superior, the western end is covered with a field extending out about 20 miles; small fields are reported over the central and eastern portions. The ice in Whitefish Bay is solid. Solid ice is reported the entire length of St. Marys River. In Green Bay the ice averages from 10 to 22 inches and is solid. In Lake Michigan the fields are small and much broken up. There are not as many fields reported over the northern portion. At the Straits of Mackinac the ice is heavily windrowed in places, and where smooth is about 20 inches in thickness. In Lake Huron the fields are reported to the north and east of Thunder Bay Island. The ice is not heavy. No fields are reported over the southern portion. Lake St. Clair is reported covered with about 7 inches of ice, with probably some open

water. The Detroit River is open. In Lake Erie the ice fields cover the western and eastern portions, but these fields are not heavy or extensive. In Lake Ontario the ice fields have not been visible to any extent during the winter. Many harbors are reported open on all the lakes.

In comparison with the same period last season there is much less ice reported in all of the lakes. At the Straits of Mackinac the same conditions prevail as last season except that the ice fields are not as extensive in Lake Michigan.

STUDIES ON THE VORTICES IN THE ATMOSPHERE OF THE EARTH.

By Prof. FRANK H. BIGELOW. Dated Washington, D. C., March 16, 1908.

VI.—THE ASYMMETRIC LAND CYCLONE AND ITS SYSTEM OF VORTEX LINES. THE CONCAVE DUMB-BELL-SHAPED VORTEX.

THE METEOROLOGICAL DATA.

It is necessary to construct a typical composite vortex, reduced to circular isobars, for the discussion of the system of vortex lines which will produce the circulation observed in the land cyclones of the United States. For this purpose the data for the nine typical cyclones in the accompanying list have been brought together, and their common properties united in the following manner. The cyclones are those of March 16, 1876; March 27, 1880; April 18, 1880; January 12, 1890; December 3, 1891; November 17, 1892; April 20, 1893; January 25, 1895; November 22, 1898. These were selected as having the center located near the middle Ohio Valley, and being approximately of the same dimensions. This insures the temperature distribution having a simple type, the warm air flowing from the south and the cold air from the north, while the normal isotherms are nearly parallel to the east and west lines. At the same time the isobars are nearly circular or broadly elliptical, and the wind vectors are but little distorted by local conditions, so that the composite cyclone will be a fair example for study.

The radii ϖ.—The construction of the isobar system is chiefly concerned with determining the proper spacing of the successive isobaric circles, and the treatment is illustrated by the cyclone of March 16, 1876. The diameter of every isobar was measured in millimeters in the northwest to southeast and the southwest to northeast directions, and the sum divided by four is the mean radius ϖ. The successive differences $\Delta\varpi$ for every tenth of an inch were found, and the mean taken for the nine selected cyclones.

TABLE 75.—*The mean radii* ϖ *and differences* $\Delta\varpi$ *for the cyclone, March 16, 1876.*

Isobars.	Measured diameters.			Mean radii.	
	NW–SE.	SW–NE.	Sum.	ϖ	$\Delta\varpi$
Inches.					
30.00	300	220	520	130	
					17
29.90	267	186	453	113	
					15
29.80	240	150	390	98	
					11
29.70	218	130	348	87	
					14
29.60	190	102	292	73	
					12
29.50	158	85	243	61	
					11
29.40	128	71	199	50	
					13
29.30	90	57	147	37	
					10
29.20	62	45	107	27	
					7
29.10	48	33	81	20	
					11
29.00	22	15	37	9	

Table 75 contains the measured diameters in two directions at right angles to each other, toward the northwest and northeast respectively, the sum, the mean radius ϖ, and the differences $\Delta\varpi$ for the cyclone, March 16, 1876. Table 76 contains the values of $\Delta\varpi$ for nine cyclones, similarly located and developed, the mean $\Delta\varpi$ and the adjusted $\Delta\varpi$ found by a graphical construction. Table 77 gives the adopted value of the radius for each tenth-inch of pressure, assuming $\varpi = 140.5$ millimeters for the isobar 30.00 inches. These are reduced by interpolation for every 5 millimeters of pressure from 760 millimeters to 735 millimeters. Then are given the $\log \varpi$ and $\log \rho = \log \varpi_n - \log \varpi_{n+1}$, and finally ϖ in meters, taking 1 millimeter on the Weather Bureau Map equivalent to 10,000 meters on the surface of the ground in the United States. It will be carefully observed that the values of $\log \rho$ instead of being constant, as in the tornado, hurricane, and in a part of the ocean cyclone, are progressive from 0.10791 to 0.43573, and this proves that the *land cyclone has departed seriously from the perfect dumb-bell vortex type*, which was found to be applicable to the other vortices in the atmosphere.

TABLE 76.—*The mean and adjusted* $\Delta\varpi$ *from the nine selected cyclones.*

Isobars.		Mar. 16, 1876.	Mar. 27, 1880.	Apr. 18, 1880.	Jan. 12, 1890.	Dec. 3, 1891.	Nov. 17, 1892.	Apr. 20, 1893.	Jan. 25, 1895.	Nov. 22, 1898.	Mean $\Delta\varpi$	Adjusted $\Delta\varpi$
Mm.	*Inches.*											
762.0	30.00											
		17	20	21	12	18	20	22	16	14	17.8	17.0
759.5	29.90											
		15	15	13	11	16	18	12	18	11	14.3	15.7
756.9	29.80											
		11	13	15	15	17	15	19	17	14	15.1	14.5
751.4	29.70											
		14	14	15	13	11	8	15	19	14	13.7	13.4
751.8	29.60											
		12	10	15	12	11	9	10	12	19	12.2	12.4
749.3	29.50											
		11	14	12	11	11	11	8	9	10	10.8	11.4
746.8	29.40											
		13	8	11	8	9	9	9	11	.....	9.6	10.6
744.2	29.30											
		10	9	8	.....	15	9	6	11	.....	9.7	10.0
741.7	29.20											
		7	10	9	.....	15	10	10	.....	.....	10.2	10.0
739.1	29.10											
		11	11	13	.....	.....	.....	6	.....	.....	10.3	10.1
736.6	29.00											

TABLE 77.—*Computation of* $\log \rho$ *for the land cyclones and the distance of the isobars from the center.*

B	ϖ	Isobars.		ϖ	$\log \varpi$	$\log \rho$	ϖ
Inches.	*Mm.*	*Inches.*	*Mm.*	*Mm.*			*Meters.*
30.00	140.5						
29.90	123.5	29.92	760	125.0	2.09691		1250000
						0.10791	
29.80	107.8						975000
29.70	93.3	29.72	755	97.5	1.98900		
						0.12390	
29.60	79.9						733000
29.50	67.5	29.53	750	73.3	1.86510		
						0.15924	
29.40	56.1						508000
29.30	45.5	29.33	745	50.8	1.70586		
						0.22874	
29.20	35.5						300000
29.10	25.5	29.13	740	30.0	1.47712		
						0.43573	
29.00	15.4						
28.90	5.0	28.94	735	11.0	1.04139		110000

The wind velocities, angles, and the temperatures.—The discussion of the wind velocities, the angle i that the wind vector makes with the tangent to the isobars, and the temperatures, has been carried on in the same way for these three quantities. From the center twelve radii were drawn across the isobars 30.00 to 29.00 inches, the radii being located as follows:

1. S.	4. E.	7. N.	10. W.
2. S. 30° E.	5. E. 30° N.	8. N. 30° W.	11. W. 30° S.
3. S. 60° E.	6. E. 60° N.	9. N. 60° W.	12. W. 60° S.

At the intersection of these radii with the isobars the wind velocity was scaled from the data on the manuscript chart and collected in Table 78, the angle i in Table 79, and the temperature t in Table 80. Examples of these data are given for the cyclone of March 16, 1876. The next step was to collect the same elements together at each point for the nine cyclones, and take out the mean values.